Notes.

The Duke of York visited Sheffield on November 4 and inspected the works of Messrs. Hadfield, Ltd., and of Messrs. Joseph Rodgers and Sons, in addition to taking part in several functions in the city. In the course of the ceremony of opening a new power station for the electricity department of the Corporation of Sheffield, his Royal Highness referred to the intention of the Corporation to extend the system of electric lighting to the homes of the working people, and went on to say:—"The enormous power station which I am about to open, with all its mechanical and scientific devices, graphically illustrates the last word in economy, and must effectively cheapen production, improve trade, and thereby lessen unemployment. If, in order to meet competition in the markets of the world, manufacturers are forced to economise, it is, in my view, a better policy to seek a solution of the problem in scientific research than merely to fall back upon a curtailment of wages. In the future the prosperity of the manual worker depends so largely upon scientific development in our industries that I would appeal to our younger generation, in whose advancement I have so deep an interest, to let this truth sink well into their minds. If Britain is to maintain her proud position among the nations of the world, they must contribute their quota of science, as in the past generation was done by such men as Kelvin, Watt, Stephenson, and Hopkinson." It is appropriate that such words should be spoken in Sheffield, the principal industry of which, the manufacture of steels of high quality, owes more than most to scientific research. The manufacturers of the city have recognised this fact in their continued support of their University, which has been closely associated with the scientific advancement of industry; and at the present moment, when industry is faced with such a host of economic difficulties, the lesson is more than ever needed, and the wise warning of the Duke of York deserves the attention of all who look for an escape from the present condition of stagnation.

The forthcoming Royal Society High Altitude Expedition to Peru sails in the third week of this month. The expedition proposes to study the adaptation of man to life at or above the altitude of 14,000 ft. As compared with other localities in which this type of work has been carried out, Peru possesses certain advantages:—(1) Being near the equator, the effects of altitude are less complicated by those of cold than in higher latitudes. (2) The Central Railway of Peru, the highest standard-gauge railway in the world, ascends the Andes to an altitude of 15,885 ft. (3) A mining population lives and works in localities situated above 14,000 and 16,000 ft., or even higher. It is alleged, for example, that the porters at the town of Cerro de Pasco, in the Andes, raise the ores 600 ft. from the mines by carrying loads of 160 lb. of mineral many times in the day. There is probably no other population which carries on such heavy work in so rare an atmosphere. Experimental methods for the study of the circulatory and respiratory systems have advanced so much within the last ten or twenty years that the time seems ripe for their application to the extraordinarily interesting problems which life at high altitudes presents. Donations towards the expenses of the expedition have been received from the following:—The Royal Society, the Harvard Medical School, the Carnegie Fund, the Moray Fund, the University of Toronto, the Rockefeller Institute, the Presbyterian Hospital, New York, Sir Peter Mackie, and Sir Robert Hadfield.

On Wednesday, November 2, the Secretary of State for War (Sir L. Worthington Evans) unveiled in the examination hall of the Pharmaceutical Society, 17 Bloomsbury Square, a bronze relief portrait of the late Lt.-Col. E. F. Harrison, who played such a prominent and important part in combating the poison gas used by the Germans. The hall, lined with a guard of honour furnished by the University of London O.T.C., was filled with a distinguished company of pharmacists, representatives of the War Office, officers in uniform, and graduates of the University in their academical robes. The platform was occupied by the president of the society (Mr. E. I. Neathercoat), the president of the British Pharmaceutical Conference (Prof. H. G. Greenish), and the Secretary of State for War (Sir L. Worthington Evans). The president alluded to Harrison's scientific career, and paid a well-deserved tribute to his energy and ability. In 1915, at the age of forty-seven, he joined the Sportsmen's Battalion as a private, but soon after the first gas attack he was transferred to the Royal Engineers and became a leading spirit in the Anti-Gas Department. His work culminated in the production of the small box respirator, which proved so effective in counteracting the poison gas that no fewer than 22,000,000 were made, Harrison being finally appointed Controller of Chemical Warfare. The Secretary of State for War acknowledged in an admirable speech the debt that the War Office owed to pharmacy for placing at their disposal the benefits of its knowledge and the marvellous results of its investigations, and on behalf of every officer and man in the Army paid a tribute of respect and gratitude to Harrison, by whose devotion and self-sacrifice thousands of lives had been saved. Science had turned the poisoned arrows of the savages into the poison gas of civilisation, and might devise weapons more deadly still, so that the soldier's need for science grew greater every day. Sir L. Worthington Evans then unveiled the memorial, the guard of honour presenting arms, and the buglers of the Coldstream Guards sounding the "Last Post"—an impressive and touching finale to a ceremony marked throughout by reverent dignity and grace.

The Radio New York Central Station, which is the most powerful transmitting station yet built, was opened on November 5 by President Harding sending a message to all the large radio stations in the world. After pointing out that such an achievement marks an epoch in the scientific development of radio communication, he said that the earnest hope of the American nation is that the peace which blesses their own land may presently become the fortune of all lands and peoples. The station belongs to the Radio Corporation of New York, which already possesses several stations capable of carrying Transatlantic traffic, notably with Great Britain, Norway, Germany, and France. These stations are said to be capable of transmitting automatically at speeds of fifty words per minute. In the new station six separate antennæ mounted on towers 400 ft. high radiate from a common centre. They are each equipped with their own 200-kw. alternator. When completed, the space occupied by the station and its radiating antennæ will be 10 square miles. It is said to be capable of transmitting at 100 words per minute. It can transmit and receive messages in all directions simultaneously. President Harding's radiogram was received by stations in Great Britain, Norway, France, Germany, and Australia, and doubtless by many others. According to the *Times*, the letters WQK are the call-letters of the new station. The frequency of the alternating-current supply is about 19,000. The wave-length used, one of the thirty-nine which have been allotted internationally to the United States, is 16,465 metres.

SECTION 1 (5) of the Safeguarding of Industries Act provided for the appointment of a referee by the Lord Chancellor to decide complaints against the inclusion or exclusion of articles from the Board of Trade's published lists of articles under the key industry part of the Act. The *Times* of October 27 contained an announcement that Mr. Cyril Atkinson, K.C., has been appointed. A day later it was announced that our Customs authorities had given notice that no further consignments of goods coming within the scope of the Act should be sent from abroad until further notice, as their staffs were inadequate to deal with the goods already lying at the docks awaiting examination. The worst prognostications of the opponents of the Key Industries Bill are thus justified. Leaving out of consideration altogether the utility of the measure, it cannot be denied that it was rushed through the Commons, where practically all amendments were brushed aside, and treated as a Money Bill, thus preventing discussion in the Lords. It is already unpopular among many manufacturers and traders, and has roused a strong feeling of resentment among scientific workers. Many complaints have been received by the Board of Trade, so that Mr. Atkinson will probably be kept busy. A deputation representing the British Association of Chemists, which was received at the Board of Trade on October 26 by Mr. P. W. Ashley, took exception to the inclusion under the Act of some hundreds of chemical products that are not made in this country at the present time, and to many other products that are deemed by the association to be outside the scope of the schedule of the Act.

THE Mount Everest Expedition returned to Darjeeling on October 25. Col. Howard Bury's last despatch to the *Times* gives an account of the journey from the base at Kharta, which occupied twenty days. The march from Kharta was up the Arun and Kaichu Valleys to Lumeh. Thence the route chosen was *via* the Quiok (Cuckoo) Pass and the Gadompa rope bridge over the Arun to Tinki Dzong and Khampa Dzong, which was reached on October 11. Messrs. Heron, Wheeler, and Raeburn then went south over the Serpola Pass and the Teesta Valley through Sikkim to Darjeeling, but, owing to the lack of transport on that route, Col. Bury and Mr. Wollaston had to take the main caravan back *via* Linghi and Phari. Heavy weather and much snow were encountered on this part of the route, but Darjeeling was reached without mishap. The season's work has been very satisfactory, and only bad weather prevented the climbers reaching a higher altitude on the possible route to the summit of Mount Everest which was found on the north-east. The coolies were a great success and gave no trouble. Many of them suffered no ill-effects at high altitudes, and have volunteered for next year's expedition. The surveyors under Major Morshead have mapped an area of more than 13,000 square miles, and Major Wheeler made a photographic survey of the whole of the Everest group. Important geological and biological collections have been made by Dr. Heron and Mr. Wollaston. The latter is also bringing back a large collection of seeds from the valleys round Mount Everest.

AT the meeting of the Royal Geographical Society on Monday the president announced that the members of the Mount Everest Expedition are now on their way home, and will be received at a meeting of the society in the Queen's Hall on December 20. Messrs. Mallory and Bullock, who climbed one of the north-eastern buttresses of Mount Everest to within some 6000 ft. of the summit, are satisfied that the actual configuration of the mountain should not prevent the top being reached. Next year's expedition is planned to leave Darjeeling about March 21 in order that May and June may be devoted to the climb, as these appear to be the best months. Col. Howard Bury is unable to resume the leadership next year, but some of the other members of this year's expedition will go out again. The climbing party is to consist of six men. Many of the Himalayan coolies employed this year have volunteered to return. The total cost of the expedition so far, excluding what the Government of India may have expended in survey, is about 5000*l*. The president paid a tribute to the Tibetan authorities for the great assistance they have shown to the expedition.

THE annual Huxley lecture of the Royal Anthropological Institute for the present year will be delivered by Mr. H. Balfour in the lecture-room of the Royal Society on Tuesday, November 29, at 8.30. The title will be "The Archer's Bow in the Homeric Poems."

THE following have been elected officers of the Cambridge Philosophical Society for the session 1921–22:—*President:* Prof. Seward. *Vice-Presidents:* Mr. C. T. R. Wilson, Dr. E. H. Griffiths, and Prof. Newall. *Treasurer:* Mr. F. A. Potts. *Secretaries:* Mr. H. H. Brindley, Prof. Baker, and Mr. F. W. Aston. *New Members of the Council:* Mr. H. H.

Thomas, Mr. R. H. Fowler, Mr. E. Cunningham, and Mr. T. C. Nicholas.

EVEN if the Oppau explosion had been heard in this country, the fact would have been very difficult to prove, and it is therefore not surprising that the Air Ministry should announce a negative result to their inquiries. The explosion took place at 6.32 a.m. (G.M.T.) on September 21, and should have been heard in England between 7 and 7.30 a.m. Only four out of forty-eight correspondents refer definitely to this time, "and there is little to indicate that the noises they mention differed from others which could not have been due to the explosion."

A SUM of 250,000*l*. has been allocated to forestry from the Unemployment Fund. The Forestry Commissioners who will administer this sum wish to direct attention to the grants that are offered, the object being the relief of the unemployed and the promotion of afforestation. As regards local authorities, a free grant of a fixed sum (approximately 60 per cent. of the labour bill) is obtainable for every acre planted. Provision has been made for assistance towards meeting unemployment by means of free grants to woodland owners who provide work for unemployed. In ordinary cases 3*l*. per acre is the sum available, but where the areas are covered with scrub the grant may amount to 5*l*. in all. Inquiries regarding grants, and offers of land for planting, should be addressed, for England and Wales, to the Assistant Commissioner, Forestry Commission, 1 Whitehall, London, S.W.1, and as regards Scotland, to the Assistant Commissioner, Forestry Commission, 25 Drumsheugh Gardens, Edinburgh.

ON November 2 the Natural History Museum Staff Association held a very successful and largely attended scientific reunion—the third and last for the current year—in the board room of the museum by permission of the Trustees. Many interesting specimens recently acquired by the museum were exhibited, the more important of them being a series of marine invertebrates from Japan collected and presented by Mr. Alan V. Insole, which included many rare and remarkable forms; the fœtal African elephant, the third known in point of smallness, presented by Mr. H. A. Hopwood; a series of minerals and rocks from the Simplon Tunnel, including fine crystals of purple anhydrite, presented by Mr. F. N. Ashcroft; and fossils, mostly ammonites, from a single bed of marl in Lower Lias at Charmouth. Lord Rothschild showed examples of melanic aberration in Lepidoptera, and considerable interest was taken in Mr. M. Maxwell's remarkable photographic enlargements of East African big game, especially those showing giraffes in full gallop. Dr. F. A. Bather gave a short lecture on "Tubular Quartzites and Sandstones."

A REPORT of the inaugural meeting of the Institution of Rubber Industry held on October 19 at the Royal Society of Arts appears in the *India-Rubber Journal* for October 22. Sir Henry Wickham, who in 1870 brought the first Hevea seeds from the banks of the Amazon to Kew, was the guest of the evening. After the address of the president, Mr. J. H. C. Brooking, Mr. H. Rogers, manager of Messrs. James Lyne Hancock, Ltd., gave an interesting review of the history of rubber manufacture. The firm mentioned was founded by the great English pioneer of the rubber industry, Thomas Hancock (1786–1865). The Indians of America were the first to use caoutchouc, and from them we get the term "India," while the word "rubber" is due to Priestley's use of the substance in 1770 for erasing pencil-marks. Up to 1840 only unvulcanised rubber was used. The credit of first producing rubber which would withstand changes in temperature without getting soft and sticky belongs to Charles Goodyer, an American, who died in 1861. In 1843 Hancock took out his patent for vulcanising by sulphur alone. This was twenty years after Macintosh had patented his method of rendering fabric impervious to rain and wind. Hancock was assisted in his development of the manufacture of rubber by his four brothers, one of whom, Walter Hancock (1799–1852), was a pioneer of steam road-cars.

IN the issue of *Discovery* for November Mr. F. W. Hall describes the excavations which have disclosed the buried Roman city of Timgad, or Thamugadi, as its founder called it, in Algeria, about a hundred miles from the northern coast and little more than twenty from the nearest French settlement at Batna. It can be compared only with Pompeii, but in some ways Timgad is even more Roman. Pompeii grew out of an old Oscan town, and its architects never had a free hand in laying it out, but Timgad, founded by the Emperor Trajan in A.D. 100, was systematically planned as a fortified frontier town to resist the attacks of the wild tribes of the south. It is built in the form of a Roman camp, a true square with an area of about 30 acres. But it is not quite symmetrical, and the avenue from east to west conforms to the alignment of the great road from Lambacsis to Theveste. Its roads, drainage system, and public baths were constructed with the efficiency which marks all Roman work; a fine system of public markets met the wants of trade, and a public library promoted intellectual culture. Its end came when in 533 Belisarius destroyed Vandal power by his victory near Carthage and, in alarm, the Berber tribes swept down from their mountains and destroyed it. Excavations by the French Government began in 1880, and have continued to the present time, throwing "a flood of light upon Roman life and history by disclosing the authentic features of a daughter city of Imperial Rome."

A LONG account, accompanied by a sketch-map, of the work of the Canadian Arctic Expedition of 1913–18 is given in the *Geographical Journal* for October by Mr. V. Stefansson. Apart from the anthropological and biological observations, which are not yet ready for publication, the main results include the rectification of the coast-line of Banks Island, Prince Albert Land, and Ellef Ringnes Island, and the discovery of two new islands in the Gustav Adolf Sea and one between Isachsen Island and Cape Thomas Hubbard. These islands have not yet received names. By a journey northward over the ice of the Beaufort Sea Mr. S. Storkersen proved the non-existence of the mythical Keenan Land by getting a sounding of more than 3000 metres on its site. It is of interest to note that during his journey Mr. Storkersen and his companions drifted on an ice-floe more than 450 miles during six months, but were unable to discover any definite current in the southern part of the Beaufort Sea; the direction of drift varied with the local winds. This absence of definite current precludes the feasibility of exploring the Beaufort Sea by an ice-bound drifting ship. On the other hand, Mr. Stefansson hopes on his next expedition to explore it by means of small sledge-parties travelling over the sea-ice and depending solely on seals for food.

"COULD the Drought of 1921 have been Forecasted?" is the subject of an article by Mr. C. E. P. Brooks in the *Meteorological Magazine* for September. The author suggests that while the abnormal weather of the past spring and summer in Europe is fresh in everyone's memory, it is an interesting exercise to apply the principles of the *Réseau Mondial,* dealing with the world's meteorology, and by constructing charts of pressure and temperature deviations from normal to attempt a prompt explanation. Charts have been constructed for the months of December, 1920, to June, 1921, comprising North America, the Atlantic, Europe, India, and much of Africa. For the period of the drought extending from February to June anticyclonic conditions prevailed generally over Europe and North America. The pressure attained its maximum near Valencia, where it was 6·2 mb. above the normal, whilst at Spitsbergen the deficiency was 6·5 mb. Temperature was slightly below the normal in the south, but much above the normal in the north. Most of the district covered by the chart suffered from drought. Especial mention is made of Exner's principle, which asserts that low pressure over the Arctic basin in winter is normally associated with high pressure over the Atlantic west and south-west of Ireland and with high temperature over the British Isles in the same season. The author extends Exner's discovery, and is of opinion that some idea of the rainfall of the spring and early summer in the British Isles may probably be obtained from a study of the pressures and temperatures of the Arctic basin during the preceding months. Low Arctic pressure is said to cause low British rainfall, and high Arctic pressure high British rainfall.

PROF. H. H. DIXON, of Trinity College, Dublin, has devised a handy method for the measurement of transparent microscopical specimens situated on the stage of any microscope possessing a reasonably good substage condenser. A small transparent screen, divided by sets of thin black lines into small squares, is held by a suitable adjustable folding stand so as to intercept normally the light falling on the plane mirror of the microscope. By a slight motion of the substage focussing adjustment the image (formed by the substage condenser) of the lines on the screen is brought into focus at the same time as the image of the specimen seen in the microscope. Of course the size of the intervals between the first images of the lines has to be measured once and for all, either accurately by means of a stage micrometer slide of the usual type, or approximately by means of some object of known dimensions. In order to keep the screen in a known position in successive measurements the top of it usually rests against the stage. The makers claim that the regular sub-division of the field by the images of the lines is of assistance in making accurate drawings of microscopic objects. As the result of tests, we can say that the arrangement fulfils all that is claimed for it. It is called the "Ghost Micrometer," and is made by Mr. G. H. Mason, 5 and 6 Dame Street, Dublin.

THE various theories of atomic structure current at the present time agree in ascribing the spectrum emitted by an atom to the electrons. If the electrons emit radiation independently of each other the separation in a magnetic field of the components of a spectral line should be proportional to the field, and deviations from this law may be taken as indication of some kind of coupling between the electrons. At the suggestion of Prof. Nagaoka, of the University of Tokyo, Mr. Y. Takahashi has measured the separations of a number of iron lines produced between nickel steel electrodes by the spark of an induction coil, in the field of an electromagnet capable of going to 37,000 gauss. The separation was observed by a Hilger echelon with a constant deviation spectroscope behind it. For the nine strong violet lines seven were found to give separations proportional to the field, while two gave larger separations in stronger fields. Of the weaker lines some give larger separations than usual, which are not proportional to the field. Both facts point to the existence of some mutual influence of the electrons on each other.

DURING the war a considerable area of Northern France and Belgium was entirely re-mapped, largely from aeroplane photographs taken by a camera rigidly fixed to the underside of the aeroplane. The method of using these photographs for map production is described in *Engineering* for October 21, in an illustrated article by Mr. R. B. Unwin. If the aeroplane were slightly tilted when the photograph was taken the result is a distorted view of the ground instead of a true map. In mapping from aeroplane photographs it is therefore necessary to form a "framework" on which to hang the photographs. The framework consists of a number of points, the exact position of which on the ground must be known, and they must be such as can be identified on the photographs. The original trigonometrical survey points were used as primary points, and as these were not sufficiently close to form a complete framework, intermediate points were fixed. These intermediate points were determined by the use of a plane table behind our lines, or if behind the enemies' lines, were deduced from the aeroplane photographs. At least four points are necessary, which were set out on a compilation diagram, and a tracing made and attached to a board which could be tilted. Lines were drawn on the negative joining the corresponding stations, and an enlarging camera was employed to project an image of the negative on the tracing. The board was then tilted until the image of the lines fitted those on the tracing, thus eliminating the effect of the tilt of the aeroplane. When sensitised paper was substituted for the tracing, the print obtained was free from distortion. and was used for plotting the map.

MESSRS. MACMILLAN AND CO., LTD., are issuing immediately vol. 1 of "The Palace of Minos," a comparative account of the successive stages of the early Cretan civilisation, as illustrated by the discoveries at Knossos, by Sir Arthur Evans, price six guineas net. The volume deals with the Neolithic and Early and Middle Minoan Ages. It will be found to be an indispensable preliminary to the study of Mycenæan Greece, the culture of which is the outgrowth of the earlier Minoan stages of Crete.

SIR WILLIAM TILDEN and Prof. J. C. Philip are editing for Messrs. G. Routledge and Sons, Ltd., a new series entitled "The Twentieth-Century Chemistry," the aim of which is the production of readable and interesting books which, without being exhaustive monographs, will furnish advanced students of chemistry with a complete survey of the present state of knowledge and opinion in each branch of the science.

MESSRS. G. BELL AND SONS, LTD., are to publish at an early date a translation, by L. Taverner, of "An Introduction to the Study of Metallography and Macrography," by L. Guillet and A. Portevin. The work will contain an introduction by Prof. H. C. H. Carpenter.

Our Astronomical Column.

THE FRENCH WIRELESS TIME-SIGNALS.—These signals are now so widely used by astronomers for time-determination that it is well to direct attention to an alteration which is announced in *Circulaire No. 4, Bureau Internationale de l'Heure.* The signals have hitherto been sent out at definite mean times; but the time is determined by meridian transits of block-stars, which necessitates the use of a sidereal clock, the error of which must be determined, and that of the mean-time clock inferred by comparison. It is now announced that, in order to avoid this transformation, beats 1 and 300 of the rhythmic signals will be sent according to Greenwich sidereal time, and the interval between the beats will be 49/50 of a sidereal second (roughly 44/45 of a mean second, instead of 49/50 as formerly).

A detailed list of the mean times of the signals, both old and new, and of the nature of the emissions used in each, is given in the circular; there are several changes. It is clear that a signal cannot be sent both at a constant mean time and a constant sidereal time: a different sidereal minute will be concerned every day. For some time after the change the signals will be preceded by the words "sidereal time," but it is not clearly explained how the actual sidereal minutes will be made known.

The new system will come into use on November 15, and will be experimented on up to the time of the meeting of the International Astronomical Union, when the question will be further discussed in the light of the experience gained.

PROPER MOTIONS OF LONG-PERIOD VARIABLE STARS.—*Astronomical Journal,* Nos. 784 and 791, contain determinations of the proper motions of thirty-seven long-period variable stars made at Mount Holyoke College by Misses Young, Farnsworth, and Jenkins. Two series of plates were taken, the time-interval ranging from nine to nineteen years. The proper motions are referred to the faint background stars, which were previously tested with a stereo-comparator, to exclude any that showed appreciable motion.

There is thus a certain amount of systematic shift in each field, arising from the solar motion, but it is unlikely to exceed 0·01″ per annum in any case. The deduced annual motion for each star is:—RR Androm., 0·060″; Y Androm., 0·021″; T Camelop., 0·016″; V Orion., 0·028″; Y Monoc., 0·031″; R Gemin., 0·022″; T Gemin., 0·029″; U Cancri, 0·019″; S Hydræ, 0·037″; T Hydræ, 0·021″; T Virg., 0·011″; S Sagittar., 0·013″; χ Cyg., 0·038″; Z Cyg., 0·018″; W Capric., 0·027″; T Delph., 0·023″; RR Aquar., 0·052″; S Ariet., 0·091″; R Ceti, 0·022″; V Gem., 0·040″; RU Herc., 0·006″; S Scorp., 0·037″; W Ophi., 0·030″; RS Herc., 0·042″; SY Cyg., 0·030″; Z Aquil., 0·023″; S Peg., 0·066″; S Aurig., 0·042″; U Puppis, 0·039″; V Leo., 0·023″; U Lib., 0·056″; U Serp., 0·049″; Y Aquar., 0·038″; T Capric., 0·014″; U Aquar., 0·020″; and R Peg., 0·038″.

The mean value is 0·032″, implying distances of the order of 100 parsecs. The sun at this distance would have magnitude 10·5, so that the stars in question have absolute magnitude (at maximum) somewhat brighter than the sun's. They are, therefore, not extreme dwarfs, but neither are they extreme giants of the type of Betelgeux. The only long-period variable with a considerable proper motion is Mira Ceti, for which Boss's value is 0·237″.

THE LAST GLACIAL EPOCH.—The Ice ages have an astronomical aspect, so that reference may be made in this column to a paper by Mr. C. E. P. Brooks (Quarterly Journal R. Met. Soc., July, 1921) which assigns the date 30,000 to 18,000 B.C. for the last great glaciation in North-West Europe (Ireland, Scotland, Scandinavia, and the Baltic). Some remains of glaciation continued until 6000 B.C.; after some intermediate phases the date 1800 B.C. to A.D. 300 is assigned to the Peat-bog Phase, when the climate was cooler and moister than at present. These changes are attributed chiefly to alterations of elevation; increased elevation has the double effect of producing glaciation on land and of closing the Straits of Dover and other channels for the warm currents from the Atlantic. Mr. Brooks also assigns considerable weight to the 1800-year cycle in tide-generating force announced by Mr. O. Pettersson. But it is very doubtful whether this cycle will explain any appreciable climatic changes. It does not mean that all the tides are higher at one of these 1800-year maxima, but merely implies that there are a few tides in the year very slightly in excess of those at other epochs, just as there are total solar eclipses of maximum duration at something like the same interval.

Since Mr. Brooks gives evidence of an approach to simultaneity in climatic changes in Europe and America, some cosmical cause is indicated; but the suggestion of a long-period variation in solar output (analogous to the short-period variations announced by Mr. Abbot) seems more hopeful than the tidal cycle.